CLAIMS

1. Variable turbocharger apparatus comprising a housing, a compressor mounted for rotation in the housing, a turbine mounted for rotation in the housing, a first inlet for enabling air to be conducted to the compressor, an outlet for enabling air from the compressor to be conducted to an engine, a second inlet for enabling exhaust gases from the engine to be conducted to the turbine in order to rotate the turbine, a chamber which surrounds the turbine and which receives the exhaust gases from the second inlet before the exhaust gases are conducted to the turbine, and a bearing assembly for permitting the rotation of the turbine, the variable turbocharger apparatus comprising vanes which are mounted in the chamber and which are for accurately directing exhaust gases on to the turbine, a piston which is slidable and which is positioned between the housing and the turbine, and control means which is connected to the piston and which is for controlling the sliding movement of the piston, the piston having an end which is nearest the bearing assembly and which defines a gap, the size of the gap being variable in dependence upon the sliding of the piston under the control of the control means, the size of the gap being effective to control the amount of the exhaust gases that act on the turbine thereby accurately controlling the speed of rotation of the turbine and thereby the amount of air conducted by the compressor through the outlet to the engine, and the variable turbocharger apparatus having at least one bypass aperture which

is closed when the size of the gap is at a minimum and which opens when the gap reaches a predetermined size, the opening of the bypass aperture being such as to allow exhaust gases that are not required for acting on the turbine to bypass the turbine.

2. Variable turbocharger apparatus according to claim 1 in which the end of the piston is such that it has a flange which extends radially outwardly.

3. Variable turbocharger apparatus according to claim 2 in which the flange has slots for receiving the vanes.

4. Variable turbocharger apparatus according to claim 3 in which the slots are open slots which extend inwardly from the periphery of the flange, or closed slots in the flange.

5. Variable turbocharger apparatus according to any one of claims 2 – 4 in which the flange is such as to allow gases to bypass a back face of the flange whilst still allowing accurate gas flow onto the turbine.

6. Variable turbocharger apparatus according to any one of the preceding claims and including a heat shield for shielding the bearing assembly from heat from the exhaust gases.

7. Variable turbocharger apparatus according to claim 6 in which the heat shield is a ring-shaped heat shield.

8. Variable turbocharger apparatus according to claim 6 in which the heat shield is a disc-shaped heat shield having an outer ring portion, an inner wall portion, and an aperture through the inner wall portion.

9. Variable turbocharger apparatus according to any one of claims 6 - 8 in which the heat shield is a floating heat shield that is held in place under pressure by spring means.

10. Variable turbocharger apparatus according to any one of claims 6 - 9 in which the vanes are mounted on the heat shield.

11. Variable turbocharger apparatus according to any one of the preceding claims in which the bypass aperture is of a V-shape in order that gases are able to bypass in a controlled manner in order to prevent turbine surging.

12. Variable turbocharger apparatus according to any one of the preceding claims in which the bypass aperture is in an insert.

13. Variable turbocharger apparatus according to claim 12 in which there is a plurality of the bypass apertures.

14. Variable turbocharger apparatus according to claim 12 or claim 13 in which the vanes are mounted on the insert.

15. Variable turbocharger apparatus according to claim 14 in which the insert is a removable insert which is removable from the housing, the removable insert being such that it facilitates assembly of the variable turbocharger apparatus.

16. Variable turbocharger apparatus according to claim 15 in which the removable insert is a slidable insert.

17. Variable turbocharger apparatus according to claim 15 or claim 16 in which the insert is held in position by spring means.

18. Variable turbocharger apparatus according to claim 17 in which the spring is such that it forms a seal for preventing gas leakage from the chamber which surrounds the turbine.

19. Variable turbocharger apparatus according to claim 14 in which the insert is a non-removable insert which is not removable from the housing.

20. Variable turbocharger apparatus according to any one of claims 15 – 19 in which the piston passes through a bore in the insert.

21. Variable turbocharger apparatus according to any one of the preceding claims in which the piston has a first abutment for forming a seal against a mating surface thereby to prevent loss of the exhaust gases between the abutment and the mating surface.

22. Variable turbocharger apparatus according to claim 21 in which the mating surface is a mating surface on a part of the housing.

23. Variable turbocharger apparatus according to claims 9 and 21 in which the mating surface is a mating surface on the insert.

24. Variable turbocharger apparatus according to any one of claims 21 – 23 in which the piston has a second abutment for engaging against the end of the vanes, thereby setting the gap when the piston is in its closed position.

25. Variable turbocharger apparatus according to any one of claims 21 – 24 and including a sealing ring for forming an auxiliary seal for preventing

loss of any of the exhaust gases that pass between the first abutment and the mating surface.

26. Variable turbocharger apparatus according to any one of claims 1 – 20 and including a ring on the piston for setting the size of the gap at a start condition, the ring also being such that it acts as an abutment for preventing gas leakage.

27. Variable turbocharger apparatus according to any one of the preceding claims in which the control means includes a fork member, which is connected to the piston on two opposed sides.

28. Variable turbocharger apparatus according to any one of claims 1 - 25 which the control means includes a U-shaped member which is connected to a face of the piston.

29. Variable turbocharger apparatus according to any one of the preceding claims in which the control means is an electronic control means which operates as part of an engine management control system.

30. Variable turbocharger apparatus according to any one of the preceding claims in which the chamber is a volute.